

REMARKS

Claims 1-10 have been examined. Claims 1-4, 6 and 7-10 have been rejected under 35 U.S.C. § 103(a). Also, the Examiner has indicated that claim 5 contains allowable subject matter.

I. Preliminary Matters

Applicant has amended the Abstract so that it better conforms to MPEP § 608.01(b) guidelines.

The Examiner has objected to the Specification due to minor informalities. Accordingly, Applicant has amended the specification.

Also, the Examiner has objected to claims 1-10 due to minor informalities. Therefore, Applicant has amended the claims according to the Examiner's suggestions. Such amendments are merely to correct minor errors, are not made in response to prior art rejections, and do not narrow the scope of the claims.

II. Rejection under 35 U.S.C. § 103(a) over U.S.P. 4,432,005 to Duffield et al. ("Duffield") in view of U.S.P. 5,712,667 to Sato ("Sato").

Claims 1, 3, 4 and 8-10 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Duffield in view of Sato.

A. Claim 1

Applicant submits that claim 1 is patentable over the cited references. For example, claim 1 recites an ink level detector for detecting at least a low ink state in which quantity of ink

stored in a sub-tank is smaller than a predetermined value, and a full ink state in which the quantity of ink stored in the sub-tank reaches a predetermined value. Claim 1 further recites an ink consumption counter, for acquiring the total quantity of ink ejected or discharged by a recording head. The ink level detector and the ink consumption counter operate simultaneously.

The Examiner acknowledges that Duffield does not teach or suggest using both an ink level detector and an ink consumption counter to determine a low ink level when the ink reaches a predetermined value, but contends that Sato does. However, although Sato discloses an ink level detector and an ink consumption counter, it fails to teach or suggest that both the detector and counter are operated simultaneously.

For example, Sato discloses a detecting step S13 (Fig. 3) to detect the level of ink remaining. Then, after detecting step S13, Sato discloses a step of calculating the amount of ink used, S15 (Fig. 3), when it is detected by the detecting step that the remainder of ink is smaller than a predetermined amount (col. 3, lines 35-44; col. 6, lines 24-56). Ink level detector 21 (Fig. 2; col. 5, lines 49-62) is used during the detecting step S13 and the ink consumption counter (recorded amount detecting means, col. 6, line 44) is used during the calculating step. Therefore, Sato fails to cure the deficient teachings of Duffield.

Accordingly, Applicant submits that claim 1 is patentable over the cited references and respectfully requests the Examiner to withdraw the rejection.

B. Claims 3 and 4

Since claims 3 and 4 are dependent upon claim 1, Applicant submits that such claims are patentable at least by virtue of their dependency.

C. Claim 8

Since claim 8 recites a method utilizing features which are analogous to the features recited in claim 1, Applicant submits that claim 8 is patentable for similar reasons as set forth above.

E. Claims 9 and 10

Since claims 9 and 10 depend on claim 8, Applicant submits that such claims are patentable at least by virtue of their dependency.

III. Rejection under 35 U.S.C. § 103(a) over Duffield in view of Sato and further in view of EP 841 173 A2 to Kobayashi (“Kobayashi”).

Claims 2 and 7 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Duffield in view of Sato as applied to claim 1, and further in view of Kobayashi. However, since claims 2 and 7 depend on claim 1, and Kobayashi fails to cure the deficient teachings of Duffield and Sato, Applicant submits that claims 2 and 7 are patentable at least by virtue of their dependency.

IV. Rejection under 35 U.S.C. § 103(a) over Duffield in view of Sato and further in view of U.S.P. 4,466,284 to Dumery (“Dumery”).

Claim 6 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Duffield in view of Sato as applied to claim 1, and further in view of Dumery. However, since claim 6 depends

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on claim 1, and Dumery fails to cure the deficient teachings of Duffield and Sato, Applicant submits that claim 6 is patentable at least by virtue of its dependency.

V. Newly added claim

Applicant has added new claim 11 to provide more varied protection for the present invention.

VI. Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

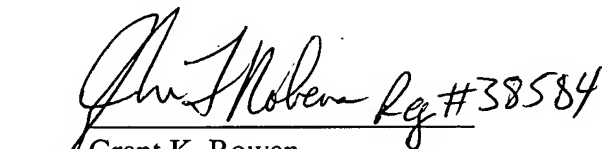
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Date: March 12, 2003

APPENDIX
VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

The specification is changed as follows:

Last paragraph beginning on page 35 and ending on page 36 is amended as follows:

A control signal for opening or closing the ink supply valve 26 is transmitted to a timer unit 112 by the consumed ink counter 109 for the sub-tank 7. The timer unit 112 starts a time count at the same time as the ink supply valve 26 is opened. When the level state detected by the Hall devices 33a and 33b still indicates a low ink state, even though a set time has elapsed, it can be assumed that the main tank 9 is in the ink exhausted (ink-out) state, or that for some reason an obstacle has appeared in the ink supply system. In this case, an error message is displayed on a display unit [13]113, as will be described later.

Page 40, last paragraph, is amended as follows:

On the other hand, if the apparatus is [son]so constituted that only the value held by the ink consumption counter 10 at step S18 is employed to perform the supply of ink to the sub-tank 7, a little error has to occur in the calculation performed by the ink consumption calculator 107 in Fig. 7. Therefore, an error is acquired by the repetitive resetting and counting performed by the ink consumption counter 109, and the quantity of ink in the sub-tank 7 is gradually increased until it enters the overflow state, or in the worst case, ink leaks from the sub-tank 7.

Alternatively, a problem may occur in that by gradually reducing the level of ink the sub-tank 7 is exhausted and air enters the ink flow path that communicates with the recording head 6.

IN THE CLAIMS:

The claims are amended as follows:

1. (Once Amended) An ink jet recording apparatus comprising:

a recording head mounted on a carriage, the recording head being reciprocally movable in a width direction of a recording sheet; and

a sub-tank[,] for supplying[, to the recording head, ink supplied]ink to the recording head from an ink cartridge, wherein the sub-tank is mounted on the carriage with the recording head, the sub-tank [including,]comprising:

an ink level detector, for detecting at least a low ink state in which quantity of ink stored in the sub-tank is smaller than a predetermined value, and a full ink state in which the quantity of ink stored in the sub-tank reaches the predetermined value, and

an ink consumption counter, for acquiring the total quantity of ink ejected or discharged by the recording head,

wherein the ink level detector and the ink consumption counter operate simultaneously,
and

wherein, when the ink level detector detects the low ink state and the value acquired by the ink consumption counter reaches a predetermined count value, ink is supplied to the sub-tank by the ink cartridge.

6. (Once Amended) The ink jet recording apparatus according to claim 1, wherein the ink level detector for detecting the quantity of ink retained in the sub-tank includes:

a float member, which floats on ink that is supplied to the sub-tank;

a permanent magnet mounted on the float member; and
a magnetoelectric element for outputting an electrical signal in response to magnetic force generated by the permanent magnet according to a relative position of a [a float]float position of the float member and the magnetoelectric element.

8. (Once Amended) An ink supply method of controlling supply of ink to a sub-tank of an ink jet recording apparatus which comprises a recording head which is mounted on a carriage and is reciprocally moved across the width of a recording sheet, the sub-tank to which ink from an ink cartridge is supplied and from which ink is supplied to the recording head, an ink level detector for detecting the quantity of ink retained in the sub-tank, and a ink consumption counter for calculating, as a count value, total quantity of ink ejected or discharged by the recording head, the method comprising the steps of:

detecting the quantity of ink stored in the sub-tank by the ink level detector;
referring to the count value acquired by the ink consumption counter and
[determined]determining whether the referred value reaches a predetermined count value
[when]where a low ink state in which the quantity of ink stored in the sub-tank is smaller than a predetermined value; [and]

supplying ink from the ink cartridge to the sub-tank when the referred value reaches the predetermined count value[.],

wherein, the detecting and referring steps are performed simultaneously.

9. (Once Amended) The method according to claim 8, wherein
when the ink level detector detects[, the detecting step,] a full ink state in which the
quantity of ink reaches the predetermined value, [the]an ink supply halt operation for halting the
supply of ink from the ink cartridge to the sub-tank is performed.

10. (Once Amended) The method according to claim 9, wherein the count value stored
in the ink consumption counter is reset when the ink supply halt operation is performed.

Claim 11 is added as a new claim.

IN THE ABSTRACT OF DISCLOSURE:

The abstract is changed as follows:

Ink from an ink cartridge [(9)] is supplied along an ink supply tube [(10)] to a sub-tank [(7)] mounted on a carriage. Provided for the sub-tank [(7)] is an ink level detector constituted by a float member [(33)] on which a permanent magnet [(32)] is mounted, and Hall devices [(33a, 33b)]. Further, a ink consumption counter is also included for calculating the quantity of ink ejected or discharged by a recording head [(6)]. When a low ink state is detected by the ink level detector and when the value held by the ink consumption counter has reached a predetermined ink quantity total, the supply of ink from the ink cartridge [(9)] to the sub-tank [(7)] is initiated.